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(54) **MULTI-LAYERED WOUND DRESSING AND METHOD OF MANUFACTURE**

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None
See application file for complete search history.

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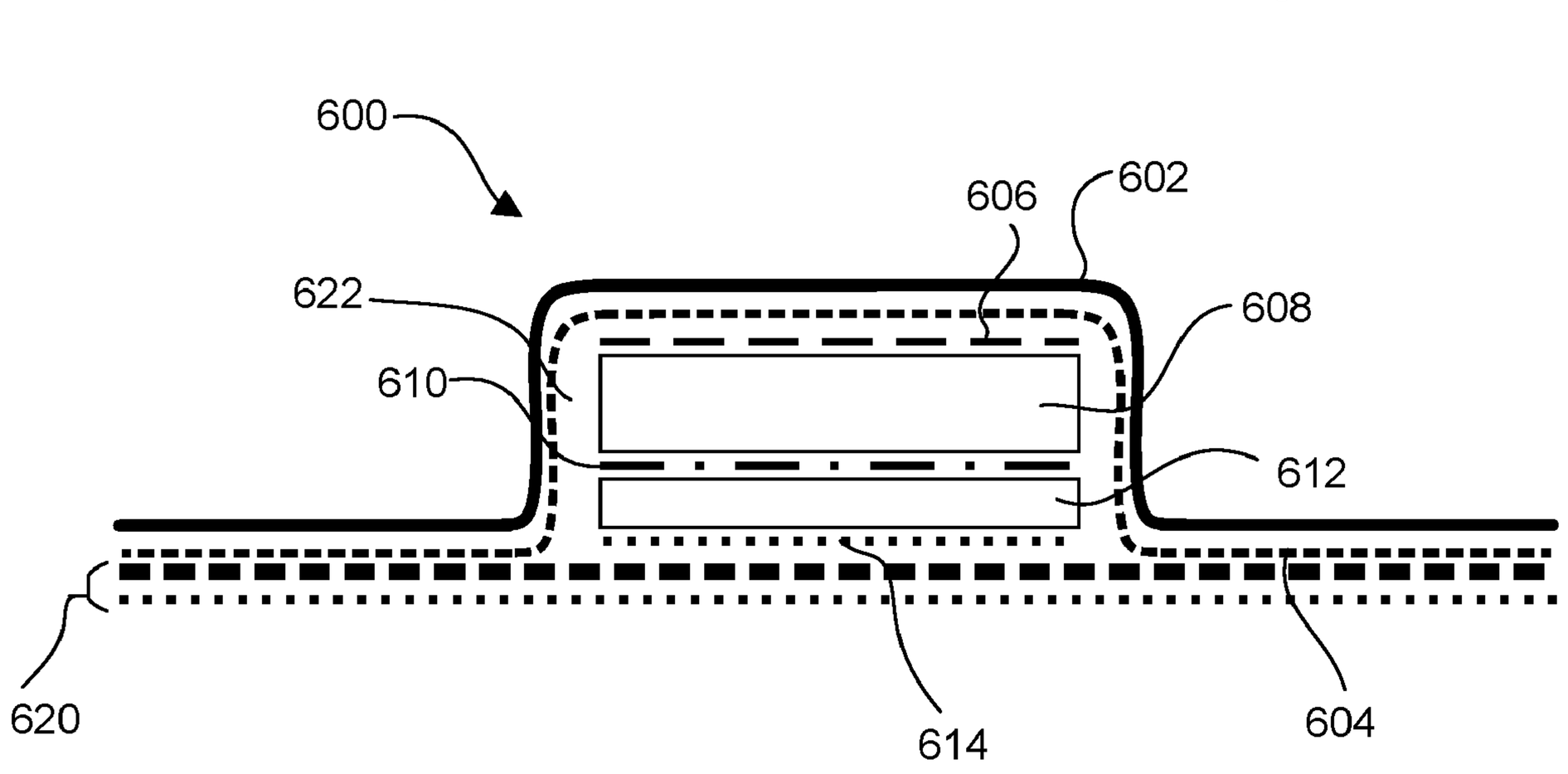
(57) **ABSTRACT**

A multi-layered wound dressing including a fibrous absorbent layer for absorbing exudate from a wound site. The wound dressing also includes a support layer configured to reduce shrinkage of at least a portion of the wound dressing.

20 Claims, 5 Drawing Sheets



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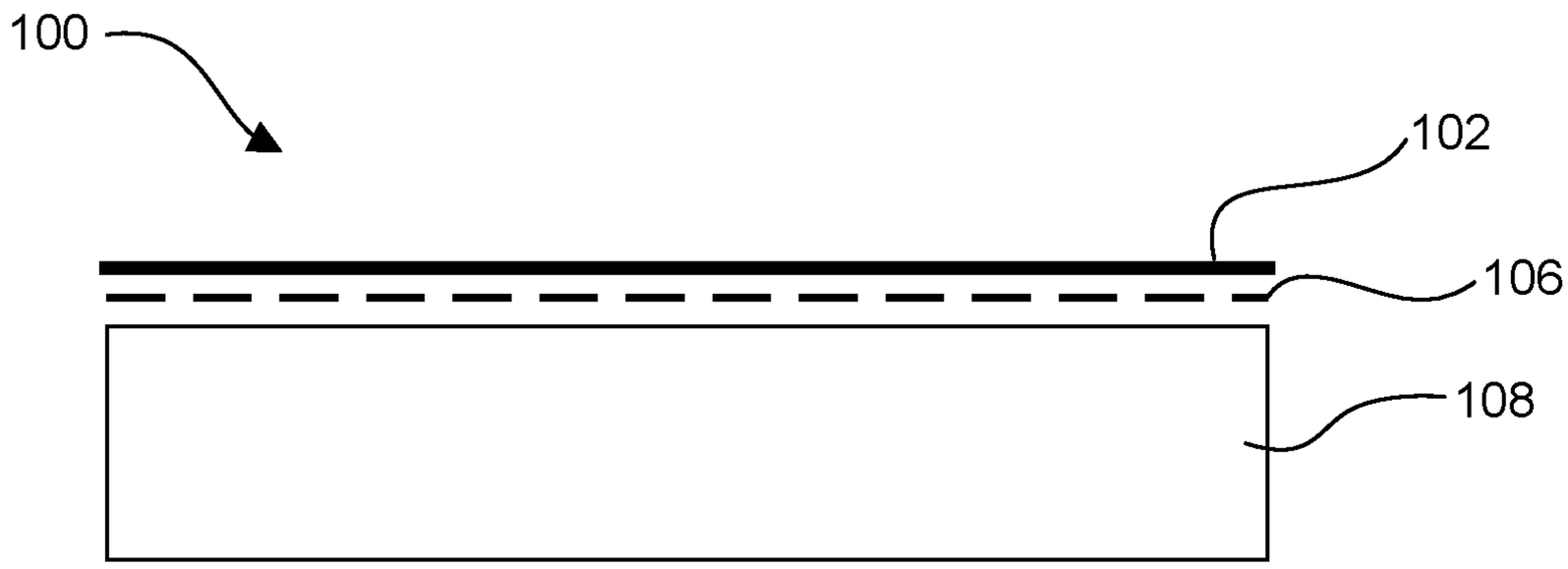

Fig. 1

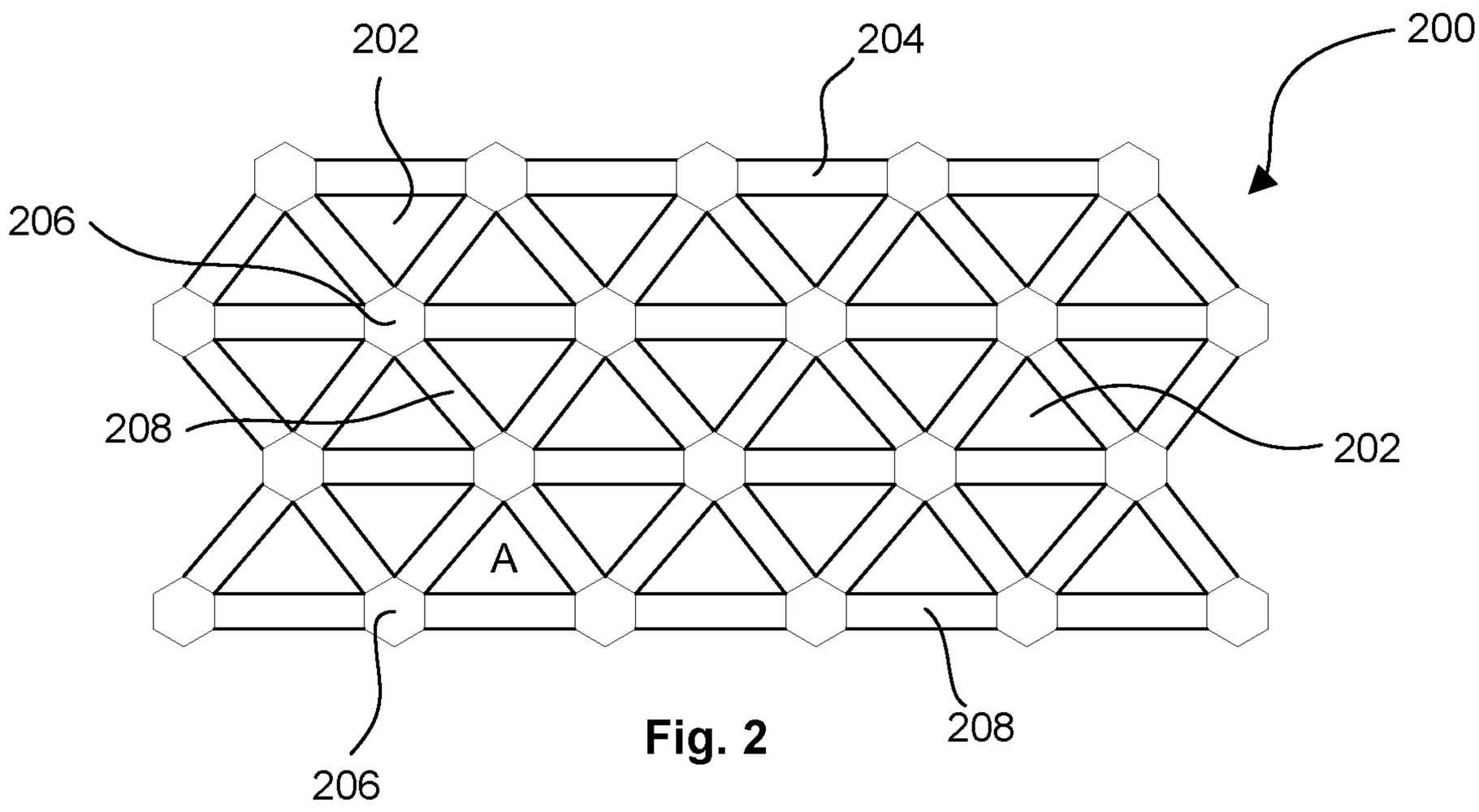

Fig. 2

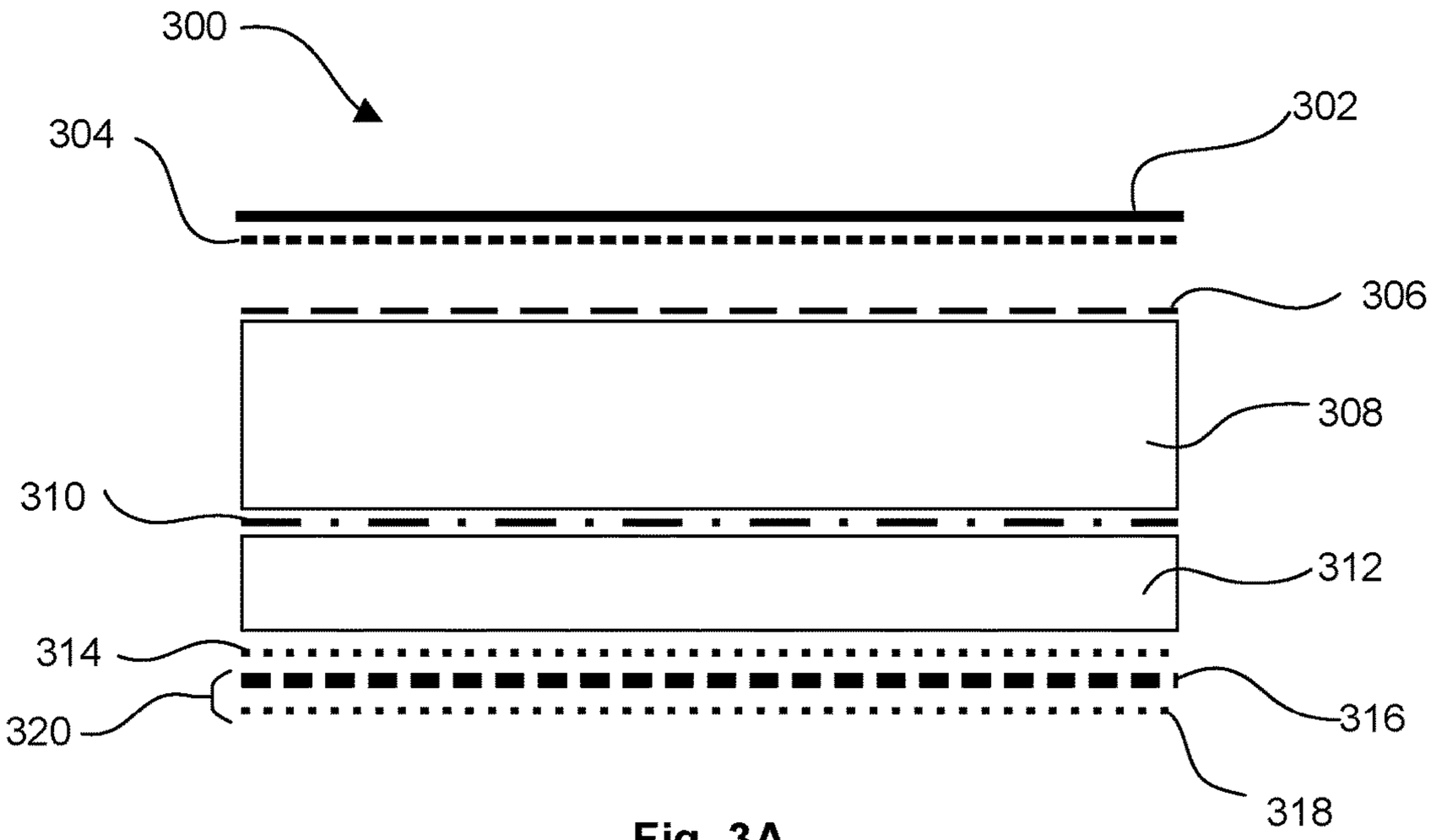
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Fig. 3A

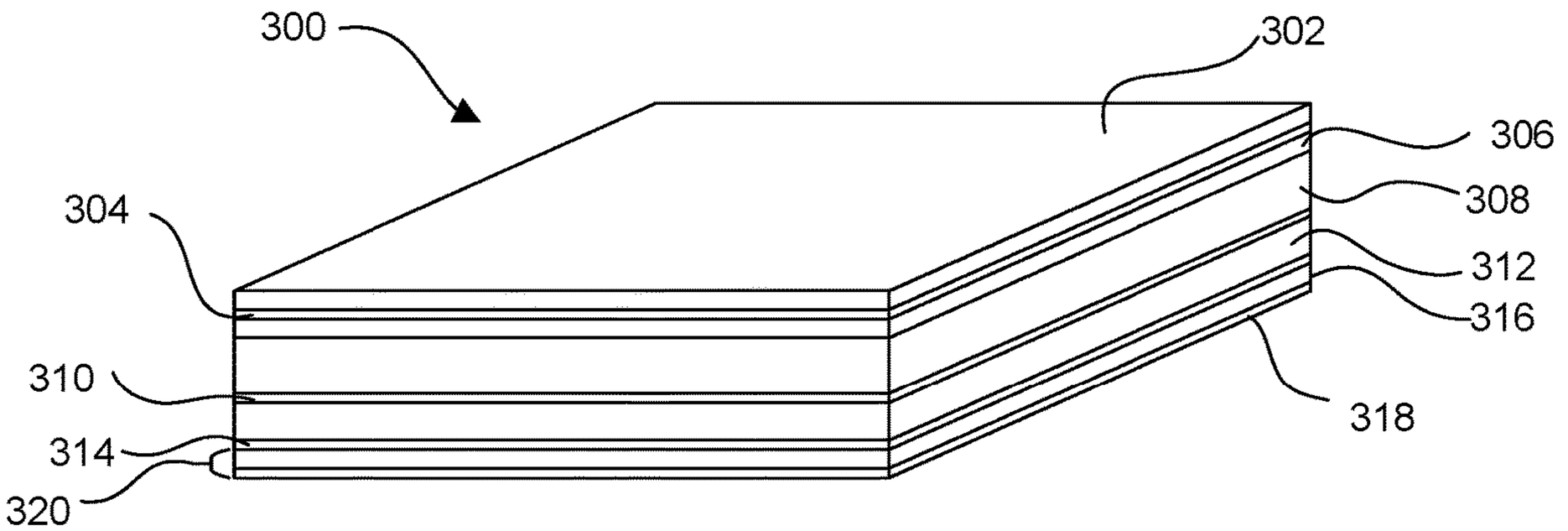
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Fig. 3B

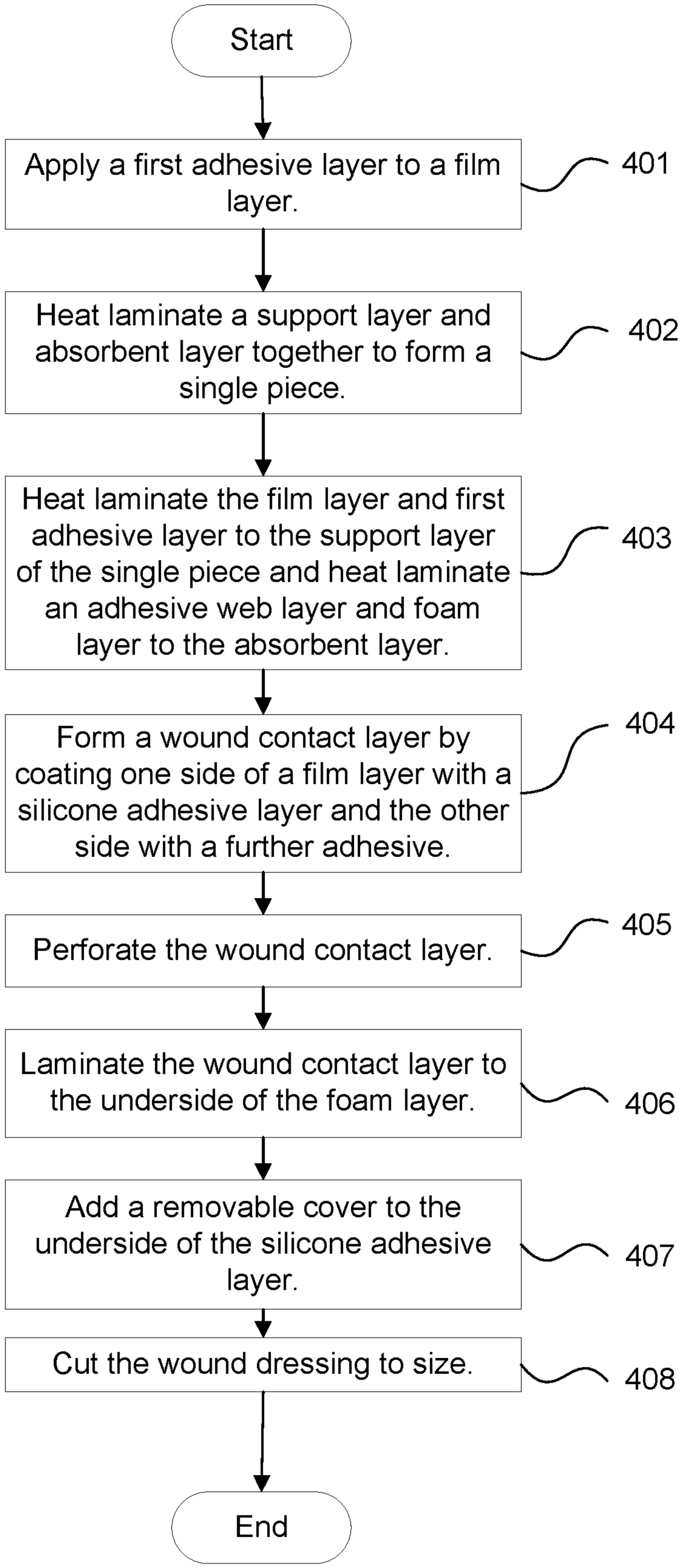
Start
Apply a first adhesive layer to a film layer.
401
Heat laminate a support layer and absorbent layer together to form a single piece.
402
Heat laminate the film layer and first adhesive layer to the support layer of the single piece and heat laminate an adhesive web layer and foam layer to the absorbent layer.
403
Form a wound contact layer by coating one side of a film layer with a silicone adhesive layer and the other side with a further adhesive.
404
Perforate the wound contact layer.
405
Laminate the wound contact layer to the underside of the foam layer.
406
Add a removable cover to the underside of the silicone adhesive layer.
407
Cut the wound dressing to size.
408
End

Fig. 4

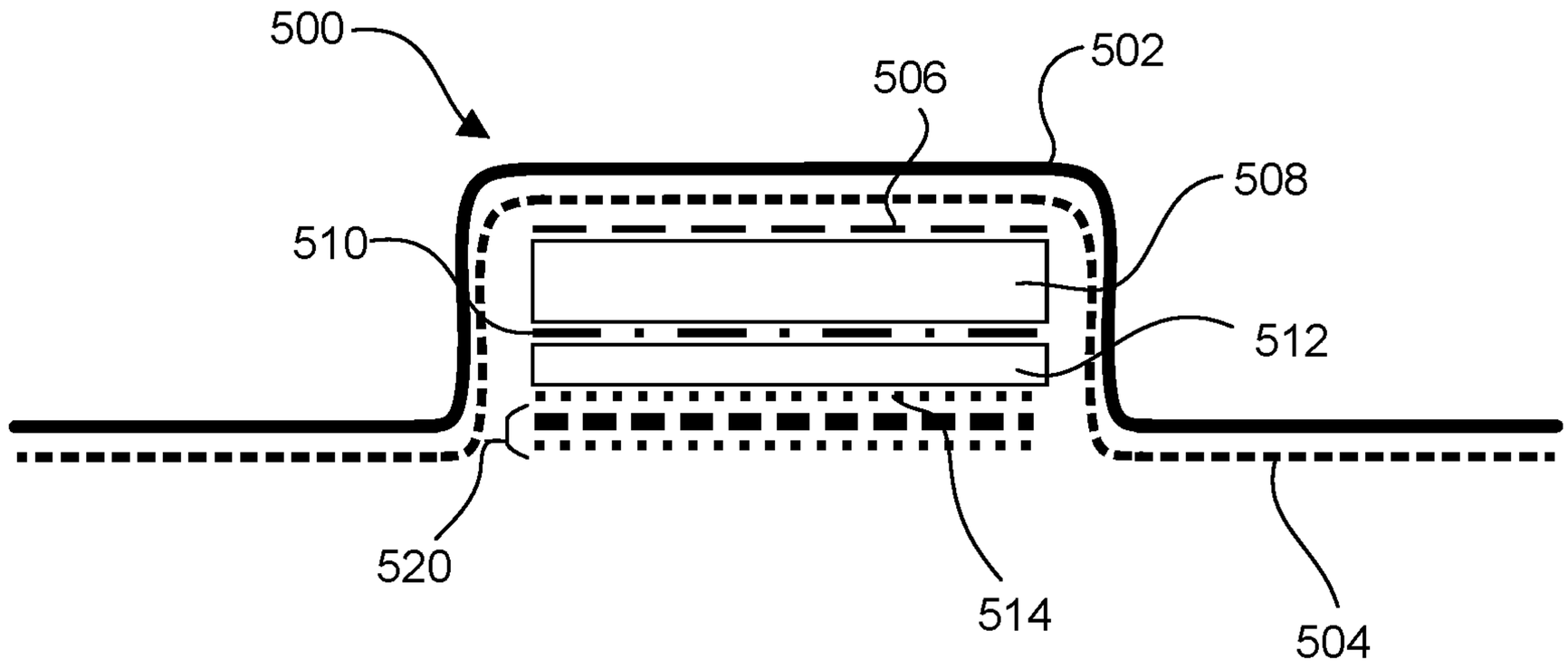
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Fig. 5

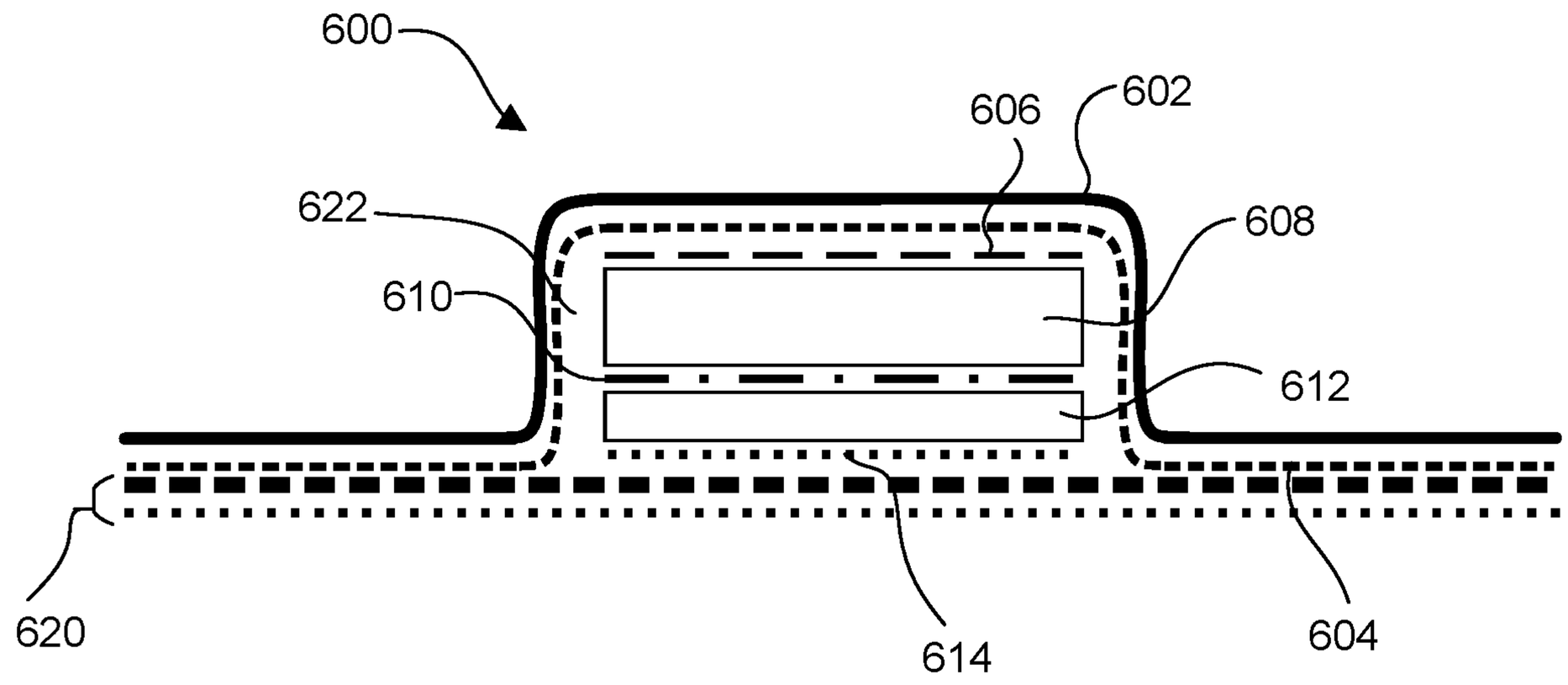
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Fig. 6

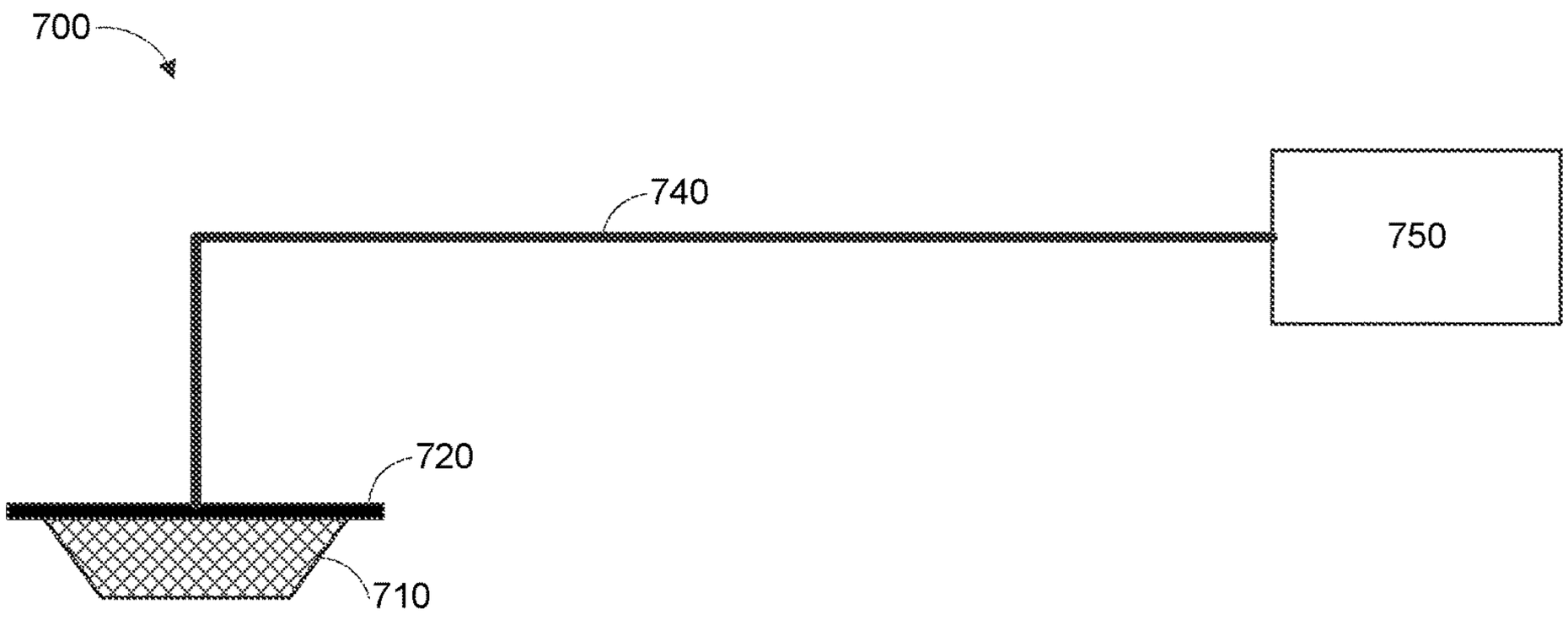

Fig. 7

MULTI-LAYERED WOUND DRESSING AND METHOD OF MANUFACTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a U.S. national stage application of International Patent Application No. PCT/EP2017/077154, filed on Oct. 24, 2017, which claims priority to GB Application No. 1618298.2, filed Oct. 28, 2016, entitled MULTI-LAYERED WOUND DRESSING AND METHOD OF MANUFACTURE.

BACKGROUND

Field

The present invention relates to a multi-layered wound dressing and a method of manufacturing such a wound dressing. In particular, but not exclusively, embodiments of the present invention relate to a multi-layered wound dressing having a fibrous absorbent layer that can resist shrinkage even under extreme sterilisation methods and storage conditions, have improved aesthetics and mechanical strength and thereby increase consistency of product over its shelf life.

Description of the Related Art

Wound dressings can be formed with a liquid-impermeable top layer (outer layer, furthest from the wound), which prevents wound exudates striking through and leaking from the dressing. The top layer is often also gas permeable and liquid vapour permeable, to help minimise maceration to the wound.

In some known wound dressings, the liquid-impermeable top layer can be susceptible to wrinkling (wrinkling includes but is not limited to inconsistent appearance, crinkles, creases textured surface). Wrinkling may occur whilst the wound dressing is packaged in a sterile packaging, and may be due to shrinking of one or more wound dressing layers over time. This may be due to the type of packaging and sterilisation method chosen. It could be perceived by a medical practitioner that if wrinkling is present the product has been compromised. Thus, it may not be possible to determine whether the wound dressing is still suitable for use. Wrinkling of the top layer may also occur whilst the wound dressing is in use. A wrinkled wound dressing is also visually unappealing to a patient.

Wound dressings often require a product shelf life of as long as possible, typically 5 years, so it is desirable to produce a wound dressing in which the liquid impermeable top layer is not as likely to wrinkle, become inconsistent in appearance or change aesthetics over time.

EP 1,314,410 discloses a multi-layered wound dressing having top film layer, but does not disclose any way of reducing or preventing shrinkage or wrinkling of the dressing.

SUMMARY

According to a first aspect of the present invention there is provided a multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site; and

a support layer configured to reduce shrinkage of at least a portion of the wound dressing.

According to a second aspect of the present invention there is provided a method of manufacturing a multi-layered wound dressing, the method comprising:

forming a support layer;

forming a fibrous absorbent layer for absorbing exudate from a wound site; and

laminating the support layer and the absorbent layer together to form the wound dressing;

wherein the support layer is configured to reduce shrinkage of at least a portion of the wound dressing.

According to a third aspect of the present invention there is provided a method of treating a wound comprising placing a multi-layered wound dressing according to any embodiment disclosed herein over a wound.

According to a fourth aspect of the present invention there is provided a method of providing negative pressure wound therapy to a wound, the method comprising:

placing a multi-layered wound dressing according to any embodiment disclosed herein over a wound;

forming a fluid flow path between the wound dressing and a negative pressure source; and

operating the negative pressure source to provide negative pressure to the wound.

According to a fifth aspect of the present invention there is provided a method of operating a negative pressure wound system, the method comprising:

operating a negative pressure source fluidically connected to a multi-layered wound dressing according to any embodiment disclosed herein, the wound dressing configured to be positioned over a wound.

According to a sixth aspect of the present invention there is provided a negative pressure wound therapy kit comprising a multi-layered wound dressing according to any embodiment disclosed herein and a negative pressure source configured to be fluidically connected to the wound dressing.

According to another aspect there is provided a multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site; and

a support layer configured to reduce shrinkage of at least a portion of the wound dressing,

wherein the support layer comprises a net, the net comprises a geometric structure having a plurality of substantially geometric apertures extending therethrough; and

the geometric structure comprises a plurality of bosses substantially evenly spaced and joined by polymer strands to form the substantially geometric apertures between the polymer strands.

According to another aspect there is provided a multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site; and

a support layer configured to reduce shrinkage of at least a portion of the wound dressing,

wherein the net is formed from high density polyethylene.

According to another aspect there is provided a multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site; and

a support layer configured to reduce shrinkage of at least a portion of the wound dressing,

wherein the support layer has a tensile strength from 0.05 to 0.06 Nm.

According to another aspect there is provided a multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site; and

a support layer configured to reduce shrinkage of at least a portion of the wound dressing,

wherein the support layer is bonded to fibres in a top surface of the absorbent layer,

the support layer further comprises a bonding layer, wherein the support layer is heat laminated to the fibres in the absorbent layer via the bonding layer; and

wherein the bonding layer comprises a low melting point ethylene-vinyl acetate adhesive.

Certain embodiments of the invention provide the advantage that at least part of the wound dressing is less likely to shrink over time compared to known wound dressings.

Certain aspects of the invention provide a wound dressing in which wrinkling in a layer or layers of a wound dressing, e.g. a liquid impermeable film layer is prevented or reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which:

FIG. **1** is a schematic diagram of a section of an example of a wound dressing;

FIG. **2** is a schematic diagram of an example of a support layer;

FIG. **3**A is a schematic diagram of a section of another example of a wound dressing;

FIG. **3**B is a perspective view of the wound dressing of FIG. **3**A;

FIG. **4** is a flow diagram of an example of a method of manufacturing the wound dressing of FIG. **3**A;

FIG. **5** is a schematic diagram of a further example of a wound dressing; and

FIG. **6** is a schematic diagram of a yet further example of a wound dressing.

FIG. **7** is a schematic diagram of an example of a negative pressure wound therapy system.

In the drawings like reference numerals refer to like parts.

FIG. **1** shows an example of a multi-layer wound dressing **100**. The wound dressing **100** includes a liquid impermeable film layer **102** located at the top of the wound dressing **100**. In use, the film layer **102** is the top layer of the wound dressing **100**, most distal from a wound site.

The film layer **102** is also gas and vapour permeable to allow for evaporation of fluid or wound exudate from the wound dressing **100**, and help prevent maceration of the wound. In this example, the film layer **102** is formed from a polyurethane blend, though other suitable materials may include other polymeric materials, for example polyethylene, or polypropylene.

An absorbent layer **108** underlies the film layer **102**. The absorbent layer **108** has a fibrous structure for absorbing exudate from a wound site. In this example, the absorbent layer **108** includes superabsorbent fibres. The absorbent layer **108** also includes other fibres. In this example, the absorbent layer includes superabsorbent fibres, viscose fibres and polyester fibres.

In this example, the absorbent layer **108** includes around 40% superabsorbent fibres, 40% viscose fibres, and 20% polyester fibres. In other examples, the absorbent layer may include around 0-50% superabsorbent fibres, 0-100% viscose fibres and 0-50% polyester fibres. Suitable superabsorbent fibres include crosslinked acrylate copolymer fibres that are partially neutralized to sodium salt however other superabsorbent fibres are available. The absorbent layer **108** may be manufactured using a needling process in which the fibres are mechanically tangled together.

In other examples, the absorbent layer may include other ratios of superabsorbent, viscose and polyester fibres. For example, the absorbent layer may include around 50% superabsorbent fibres, 35% viscose fibres and 20% polyester fibres. Alternatively, the absorbent layer may include 40% superabsorbent fibres and 60% viscose fibres.

The film layer **102** is located over the absorbent layer **108** so that wound exudate collected in the absorbent layer **108** can evaporate out of the wound dressing **100** through the film layer **102**.

A support layer **106** is located between the film layer **102** and the absorbent layer **108**. The support layer **106** helps to reinforce the structure of the absorbent layer **108** and thereby reduce shrinkage of the wound dressing **100**. The support layer **102** also helps to provide extra mechanical strength to the film layer **102** to reduce or prevent wrinkling of the film layer **102** over time. The mechanical strength also reduces the chance of the dressing deforming or rolling up causing a pressure point.

Aptly, the support layer **106** is configured to have a tensile strength from 0.05 to 0.06 Nm to provide mechanical strength to the surrounding layers (e.g. the film layer **102** and the absorbent layer **108**) without compromising the flexibility of the wound dressing **100**. The support layer **106** may have a thickness of from 50 to 150 μm. Aptly, the support layer **106** may have a thickness of around 100 to 110 μm.

Referring to FIG. **2**, the support layer **106** includes a net **200** configured to reduce shrinkage of the wound dressing **100**. Aptly, the net **200** is configured to reduce shrinkage of the absorbent layer **108** and/or the film layer **102** to help reduce wrinkling of the film layer **102**.

In this example, the net **200** has a substantially hexagonal (or honeycomb) structure **204** including a plurality of substantially triangular shaped apertures **202** extending therethrough.

The hexagonal structure **204** is formed from a plurality of dots (or bosses) **206** joined by polymer strands **208**. The dots **206** are substantially evenly spaced with respect to each other. Each dot forms a vertex of the hexagonal pattern in the structure **204**. Each dot **206** is joined to six surrounding dots **206** by polymer strands **208**. That is, six polymer strands **208** extend from each dot **206** and each connect to a respective surrounding dot **206** to form the hexagonal structure **204** having triangular shaped apertures **202** between the polymer strands **208**.

Each of the triangular shaped apertures **202** may have an area A of from 0.005 to 0.32 mm^2. This allows liquid vapour from a wound to pass freely through the apertures, whilst still providing sufficient strength to the support layer **106**.

It can also be said that the structure **204** is a structure comprising a plurality of strands or struts that are joined to form a plurality of triangles. In this example the triangles tessellate in rows. It will be appreciated that the strands or struts may be arranged in other formations, for example squares, diamonds or rectangles with different geometries and therefore differing open areas.

In this example, the support layer **106** is located directly adjacent the absorbent layer **108**. As such, the support layer **106** can effectively provide additional mechanical strength to fibres in the top surface of the absorbent layer **108**. This can help prevent movement of the fibres and reduce shrinking of the absorbent layer **108**.

Aptly, the support layer **106** is bonded to the fibres in the top surface of the absorbent layer **108**. This can help to lock the fibres in position and prevent or reduce any movement.

In this example, the support layer **106** further includes a bonding layer for heat laminating the net **200** to the absorbent layer **108**. The support layer **106** is thus heat laminated to fibres in the absorbent layer **108** via the bonding layer.

The bonding layer contained within the net has a lower melting temperature than the net **200** so that the support layer **106** can be heat laminated to the absorbent layer **108** whilst maintaining the structure of the net **200**. The bonding layer can be formed from a low melting point polymer, for example a low melting point ethylene-vinyl acetate, whilst the net **200** may be formed from a high density polyethylene, which melts at a higher temperature than the bonding layer. Other polymers having a lower melting point than the net **200** may also be suitable. For example the bonding layer may be a separate layer or alternatively include an ethylene-acrylate or thermoplastic polyurethane based adhesive.

The net **200** and the bonding layer can be coextruded to form the support layer **106**. Aptly, the bonding layer is extruded with a similar structural shape to the net **200**, so that the apertures **202** in the net **200** are not obstructed by the bonding layer. This helps to ensure that exudate the absorbent layer **108** can pass through the support layer and evaporate out of the wound dressing **100** through the film layer **102**.

FIG. **3** illustrates another example of a multi-layered wound dressing **300**. The wound dressing **300** includes a film layer **302**, support layer **306** and absorbent layer **308**, the same as the film layer **102**, support layer **106** and absorbent layer **108** described in relation to FIG. **1**.

The wound dressing **300** also includes a first adhesive layer **304**, located between the film layer **302** and the support layer **306**, for attaching the film layer **302** to the support layer **306**. The first adhesive layer **304** is a hot melt adhesive applied to a wound facing side (underside) of the film layer **302**. Aptly, the first adhesive layer **304** is pattern coated onto the film layer **302**, to include holes, so that gas and liquid vapour can pass through holes in the first adhesive layer **304**. In other examples the film layer **302** may be laminated (e.g. heat laminated) directly onto the support layer **306** without the need for an adhesive layer **304** in between.

In this example, the wound dressing **300** also includes a foam layer **312**, which is a fluid transport layer. The foam layer **312** is located under the absorbent layer **306**. The foam layer **312** acts to draw fluid away from a wound site and transport the fluid to the absorbent layer **308**. The foam layer may be formed from an open cell polyurethane foam and other options are available, as will be recognised by those skilled in the art.

An adhesive web layer **310** is located between the foam layer **312** and the absorbent layer **308** to adhere the foam layer **312** to the absorbent layer **308**. The adhesive web layer may be formed from bicomponent polypropylene/polyethylene fibres. Such bicomponent fibres are known in the art, so for brevity will not be discussed in detail. The adhesive web layer **310** includes a plurality of apertures extending therethrough to allow for passage of exudate from the foam layer **312** to the absorbent layer **108**.

The wound dressing **300** also includes a wound contact layer **320**, which includes a perforated film **316**. The perforated film **316** is located under the foam layer **312** and helps to prevent the wound dressing **300** from attaching to the wound as the wound heals. For example, where the wound dressing **300** includes the foam layer **312**, the perforated film **316** can prevent new tissue from growing into cells of the foam layer **312**. In other examples, the foam layer **312** may not be present and the perforated film **316** can help prevent fibres of the absorbent layer **308** from becoming embedded in the wound. Perforations in the perforated film **316** are aptly substantially uniformly distributed and are of suitable size to allow passage of exudate into the wound dressing **300**, e.g. with holes having a diameter of 1-2.5 mm. The perforated film **316** is aptly formed from polyurethane.

The wound contact layer **320** may also include an adhesive **318** located under the perforated film **316** (i.e. on the wound facing side of the perforated film **316**) for adhering the wound dressing **300** to the skin. In this case the adhesive is silicone **318** and is aptly spread onto the underside of the perforated film with a coat weight of around 30-200 g/m^2. In some other examples, an additional attachment element, for example bandages, strips of tape, or compression bandages may be used to secure the wound dressing **300** to the patient.

The top side of the perforated film **316** (i.e. the side distal from the wound) may be coated with a further adhesive layer **314**. The further adhesive layer **314** adheres the wound contact layer **320** to the foam layer **312**. Aptly, the further adhesive layer **314** may be an acrylic adhesive, though other suitable adhesives may also be used. In other examples the wound contact layer **320** may be laminated (e.g. heat laminated) directly to the foam layer **312**, without the need for the further adhesive layer **314** in between.

FIG. **4** illustrates an example of a method of manufacturing the wound dressing **300**. The method is not limited to the steps shown and, as described above, may include additional steps. The method also is not limited to the order shown in FIG. **4**. As will be appreciated by those skilled in the art, several of the method steps shown may be performed in a different order. In some embodiments, the wound dressing **300** is manufactured by forming each of the layers, and assembling the layers in the correct order, before heat laminating them together.

The film layer **302** may be formed by extrusion. At step **401**, the first adhesive layer **304** is applied to the film layer. Aptly, the first adhesive layer **304** is pattern coated onto the underside of the extruded film layer **302**.

At step **402** the support layer **306** and the absorbent layer **308** are heat laminated together to form a single piece. At step **403** the film layer **302** and first adhesive layer **304** are heat laminated to the support layer **306** on the top side of the single piece and the adhesive web layer **310** and foam layer **312** are heat laminated to the absorbent layer **308**. Whilst the layers have been described as being heat laminated together in a specific order, the layers may be separately laminated together or laminated together all at the same time.

At step **404** the wound contact layer **320** is formed by coating one side of a film layer with the silicone adhesive layer **314**, and coating the other side of the film layer with a further adhesive layer **314**. The film layer is then perforated at step **405** (e.g. by needle punching), to form the wound contact layer **320** including the perforated film **316**, the silicone adhesive layer **314** for contacting the wound and the further adhesive layer **314**. Alternatively, the film layer may be perforated before adding the further adhesive layer **314**.

The wound contact layer may then be laminated (e.g. with heat, ultrasonic and/or radio frequency welding) to the underside of the foam layer **312** to form the wound dressing **300**, as shown at step **406**.

At step **407** a removable cover may be applied to the underside of the silicone adhesive layer **318**. This cover can be removed before the wound dressing **300** is applied to a patient.

At step **408** the wound dressing **300** may be cut into separate wound dressing pieces, each suitably sized for an intended application.

In another example, as shown in FIG. **5**, the film layer **502** may have a larger surface area than the remainder of the wound dressing **500** so that it extends further outwardly than the other layers of the wound dressing. The wound-facing (underside) of the film layer may be coated with a pressure sensitive adhesive **504** (or other suitable adhesive) for sticking the dressing to the patient around the wound periphery. The pressure sensitive adhesive **504** may also adhere the film layer **502** to the support layer **506** of the wound dressing **500**. The wound dressing may also include an absorbent layer **508**, adhesive web layer **510**, foam layer **512**, further adhesive layer **514** and wound contact layer **520**. Each of the layers in this example may be similar to corresponding layers described above in relation to FIGS. **3**A and **3**B, so for brevity will not be described again in detail.

In this example, the wound dressing may be manufactured following steps **401** to **407** described above. However, instead of cutting the dressing to size (step **408**) each wound dressing may be made individually with each layer cut or formed to the desired size prior to laminating all the layers together so that the final wound dressing has a film layer larger than the other layers.

In a further example, as shown in FIG. **6**, both the wound contact layer **620** and the film layer **602** may extend beyond the remaining layers of the wound dressing **600**. The wound contact layer **620** and the film layer may be adhered together around the periphery (e.g. via an adhesive layer **604**), so that the remaining layers of the wound dressing are sandwiched between the wound contact layer **620** and the film layer **602**. In other words the support layer **606**, the absorbent layer **608**, the adhesive web layer **610**, and the foam layer **612** may be sealed within a cavity **622** between the film layer **602** and the wound contact layer **620**. In this example, a further adhesive layer **614** adheres the foam layer **612** to the wound contact layer **620**, though in other examples the further adhesive layer **614** may not be required. Each of the layers in this example may be similar to corresponding layers described above in relation to FIGS. **3**A and **3**B, so for brevity will not be described again in detail.

The wound dressing **600** in this example may be manufactured similarly to the wound dressing **300**, as described above, but with the film layer **602** and the wound contact layer **620** being laminated together around the periphery (e.g. via the adhesive layer **604**) to sandwich the remaining layers between the film layer **602** and the wound contact layer **620**. Alternatively, the film layer **602** may be directly laminated around the periphery (e.g. heat laminated) to the wound contact layer **620**, without the need for the additional adhesive layer **604**.

Although the wound dressings **300**, **500**, **600** have been described having several adhesive layers, one or more of these layers may not be present. For example, the perforated film itself may be formed from a hot melt adhesive material so that it can be directly heat laminated onto the foam layer, in which case the further adhesive layer may not be needed. In another example, the adhesive web layer may not be present if the foam and absorbent layers are adhered in another way. For example, the foam and absorbent layers may be directly chemically bonded together. Similarly, the first adhesive layer may not be needed. For example if the support layer includes an adhesive material, or if the film layer itself is formed from a hot melt adhesive then the film layer and the support layer may be directly adhered together.

In another example, the wound dressing may be provided without the foam layer. The foam layer helps to transport exudate away from the wound. However in some cases, and depending on the severity of a wound, the absorbent layer may sufficiently draw exudate from the wound without the need for the foam layer.

Although in the examples described above, the support layer is heat laminated to the absorbent layer via a bonding layer, other laminating techniques may be suitable. For example, the bonding layer may include a pressure sensitive adhesive. In this case, heat may not be required to laminate the support layer and adhesive layer together.

Although in the example described above, the net layer has been described as having a substantially hexagonal shaped structure, other geometric structures may also be suitable.

With other geometric structures, the apertures may also have different geometric shapes.

In another example, the wound dressing may include more than one support layer to provide support to other layers in the wound dressing. For example a first support layer may be located between the liquid impermeable film layer and the absorbent layer, and a further support layer may be located between the absorbent layer and the fluid transport layer (foam layer). This may help to support the absorbent layer from both sides to further reduce shrinking of the absorbent layer.

Any of the examples described herein may be adapted for use with a negative pressure system (sometimes referred to as a reduced pressure system) including a source of negative pressure, such as a negative pressure pump. For example, the film layer may include a negative pressure interface, such as a port, to which a negative pressure supply tube may be connected. The supply tube may be connected to a negative pressure source so that, in use, the negative pressure source applies a negative pressure to the wound dressing between the film layer and the wound to help draw wound exudate away from the wound and into the absorbent layer of the dressing.

FIG. **7** illustrates an example of a negative pressure wound therapy system **700**. The system includes a wound cavity **710** covered by a wound dressing **720**, which can be a dressing according to any of the examples described herein. The dressing **720** can be positioned inside the wound cavity **710** and further seal the wound cavity so that negative pressure can be maintained in the wound cavity. For example, a film layer of the wound dressing **720** can provide substantially fluid impermeable seal over the wound cavity **710**. A single or multi lumen tube or conduit **740** connects the wound dressing **720** with a negative pressure device **750** configured to supply reduced pressure. The negative pressure device **750** includes a negative pressure source. The negative pressure device **750** can be a canisterless device (meaning that exudate is collected in the wound dressing and/or is transferred via the tube **740** for collection to another location). In some embodiments, the negative pressure device **750** can be configured to include or support a canister. Additionally, in any of the embodiments disclosed herein, the negative pressure device **750** can be fully or partially embedded in, mounted to, or supported by the wound dressing **720**.

The conduit **740** can be any suitable article configured to provide at least a substantially sealed fluid flow path or pathway between the negative pressure device **750** and the wound cavity **710** so as to supply reduced pressure to the wound cavity. The conduit **740** can be formed from polyurethane, PVC, nylon, polyethylene, silicone, or any other suitable rigid or flexible material. In some embodiments, the wound dressing **720** can have a port configured to receive an end of the conduit **740**. For example, a port can include a

hole in the film layer. In some embodiments, the conduit **740** can otherwise pass through and/or under a film layer of the wound dressing **720** to supply reduced pressure to the wound cavity **710** so as to maintain a desired level of reduced pressure in the wound cavity. In some embodiments, at least a part of the conduit **740** is integral with or attached to the wound dressing **720**.

In use, the wound dressing, such as the wound dressing **100**, **300**, **500**, or **600**, is applied to a wound site with the wound contact layer **320** contacting the wound. Exudate from the wound may pass through the perforated film **116** and into the foam layer **312**, which acts to transport wound exudate away from the wound into the absorbent layer **308**. Wound exudate collected in the absorbent layer **308** can evaporate from the wound dressing **300** through the vapour permeable film layer **302**.

The support layer helps to provide mechanical strength to the absorbent layer, which may swell when it is wet and may shrink as it dries. The support layer can help to minimise movement of fibres in the absorbent layer at least on the side distal from the wound and thus helps to prevent shrinking of the wound dressing, particularly in this region. Minimising shrinking of the wound dressing in this way can in turn can help to prevent wrinkling of the film layer. It also reduced the chance of the dressing rolling/folding up under secondary retention.

As the wound dressing becomes exposed to moisture (either from the wound or the surrounding atmosphere), it may swell or expand causing increased wrinkling of the film layer. Having the support layer adhered to the film layer can help to provide support to the film layer and resist wrinkling of the film layer by providing additional mechanical strength to the film layer.

The above described wound dressings are less likely to exhibit shrinking whilst stored in sterile packaging than previously known wound dressings. Thus, wrinkling of the film layer on the outside of the wound dressing can be prevented or reduced. A medical practitioner is therefore less likely to disregard a wound dressing that is still within its recommended shelf life, sterile and suitable for use, purely because of visual appearance of the film layer.

The hexagonal and/or triangular shape of the net structure of the support layer helps to provide mechanical strength and can be particularly effective at resisting against shrinkage of surrounding wound dressing layers.

Throughout the description and claims of this specification, the words "comprise" and "contain" and variations of them mean "including but not limited to", and they are not intended to (and do not) exclude other moieties, additives, components, integers or steps. Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. The invention is not restricted to the details of any foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

The invention claimed is:

1. A multi-layered wound dressing comprising:

a fibrous absorbent layer for absorbing exudate from a wound site;

a support layer configured to reduce shrinkage of at least a portion of the multi-layered wound dressing; and

a liquid impermeable film layer,

wherein the support layer is located between the absorbent layer and the film layer, and

wherein the support layer has a tensile strength from 0.05 to 0.06 Nm.

2. A multi-layered wound dressing according to claim **1**, wherein the support layer comprises a net.

3. A multi-layered wound dressing according to claim **2**, wherein the net comprises a geometric structure having a plurality of substantially geometric apertures extending therethrough.

4. A multi-layered wound dressing according to claim **3**, wherein the geometric structure comprises a plurality of bosses substantially evenly spaced and joined by polymer strands to form the plurality of substantially geometric apertures between the polymer strands.

5. A multi-layered wound dressing according to claim **4**, wherein the geometric structure of the net comprises a hexagonal structure, and wherein the plurality of substantially geometric apertures have triangular shape.

6. A multi-layered wound dressing according to claim **5**, wherein a boss of the plurality of bosses form a vertex of the hexagonal structure with polymer strands extending from the boss and connecting the boss to neighboring bosses, and wherein the plurality of substantially geometric apertures are formed between neighboring polymer strands.

7. A multi-layered wound dressing according to claim **2**, wherein the net is formed from high density polyethylene.

8. A multi-layered wound dressing according to claim **3**, wherein the plurality of substantially geometric apertures have an area from 0.005 to 0.32 mm^2.

9. A multi-layered wound dressing according to claim **1**, wherein the support layer has a thickness of from 50 to 150 μm.

10. A multi-layered wound dressing according to claim **1**, wherein the support layer is located directly adjacent the absorbent layer.

11. A multi-layered wound dressing according to claim **1**, wherein the support layer is bonded to fibres in a top surface of the absorbent layer.

12. A multi-layered wound dressing according to claim **11**, wherein the support layer further comprises a bonding layer, wherein the support layer is heat laminated to the fibres in the absorbent layer via the bonding layer.

13. A multi-layered wound dressing according to claim **12**, wherein the bonding layer comprises a low melting point ethylene-vinyl acetate adhesive, and wherein the support layer comprises a net formed from a material with a higher melting temperature than that of the bonding layer.

14. A multi-layered wound dressing according to claim **1**, further comprising an adhesive layer attaching the film layer to the support layer.

15. A multi-layered wound dressing according to claim **1**, further comprising a wound contact layer located adjacent the absorbent layer for positioning adjacent a wound.

16. A multi-layered wound dressing according claim **15**, further comprising a fluid transport layer between the wound contact layer and the absorbent layer for transporting exudate away from a wound into the absorbent layer.

17. A method of treating a wound comprising placing a multi-layered wound dressing according to claim **1** over a wound.

18. A method of manufacturing a multi-layered wound dressing, the method comprising:

forming a support layer that comprises a net layer and a bonding layer by coextruding the net layer and the bonding layer;

forming a fibrous absorbent layer for absorbing exudate from a wound site; and

laminating the support layer and the absorbent layer together to form the wound dressing by attaching the bonding layer to the absorbent layer;

wherein the support layer is configured to reduce shrinkage of at least a portion of the multi-layered wound dressing, and

wherein the support layer has a tensile strength from 0.05 to 0.06 Nm.

19. A method according to claim **18**, wherein the bonding layer is formed from a polymer with a first melting temperature and the net layer is formed from a material with a second melting temperature higher than the first melting temperature of the polymer of the bonding layer, and wherein laminating the support layer and the absorbent layer comprises laminating by using heat so that the net layer maintains its structure during application of heat.

20. A method according to claim **18**, further comprising heat laminating the support layer to fibres in the absorbent layer via the bonding layer, wherein the bonding layer comprises a low melting point ethylene-vinyl acetate adhesive, and wherein the support layer comprises a net formed from a material with a higher melting temperature than that of the bonding layer.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 11,559,437 B2
APPLICATION NO. : 16/345196
DATED : January 24, 2023
INVENTOR(S) : Daniel Lee Steward

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 3, Line 41, below "In the drawings like reference numerals refer to like parts." insert -- DETAILED DESCRIPTION --, as a new heading.

Column 8, Line 14-15, delete "With other geometric structures, the apertures may also have different geometric shapes." and insert the same on Column 8, Line 13 as a continuation of the same paragraph.

In the Claims

Column 11, Line 7, in Claim 16, after "according" insert -- to --.

Signed and Sealed this
Fourth Day of April, 2023

Katherine Kelly Vidal

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office